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"SILK ROAD CAMEL: THE CAMELIDS, MAIN STAKES FOR SUSTAINABLE DEVELOPMENT"

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SESSION 2. THE PRODUCTION AND PRODUCTS OF CAMELIDS

EFFECT OF SLAUGHTER SEASON ON FATTY ACIDS COMPOSITION OF DESERT CAMEL MEAT (*CAMELUS DROMEDARIUS)*

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Abstract

The study aimed to study the effect of slaughter season on fatty acids composition of camel *Longissimus thoracis* muscle. Desert camel calves (*n=30*) were fattened by local camel herders in Sudan and slaughtered in different seasons of the year: winter, summer and autumn (ten camels each). The average of total lipids of the three seasons was 11.7 g/ 100g fresh muscle, showed no differences among seasons. Camel LT muscle contained 52.2% SFA, 35.8% MUFA, 11.6 PUFA and 0.5% CLA, respectively. Slaughter season influenced the total MUFA which found high in summer compared to other seasons. As well, the ratio of 18:2 n-6/ 18:3 n-3, n-6/ n-3 as well as UFA/ SFA were influenced by slaughter season (*P<0.05*). CLA content and the percentages of *trans*11, *cis* 9 18:2 isomer are relatively high, while n-6/ n-3 ratio was within the recommended values for the human diet which indicated that camel LT muscle has a high nutritional value throughout the year.

Key words: lipids, desert camel, fatty acids, slaughter season

ҚАСАПШЫЛЫҚ МЕЗГІЛДІҢ ШӨЛДЕГІ ТҮЙЕЛЕР (CAMELUS DROMEDARIUS) ЕТІНІҢ МАЙ ҚЫШҚЫЛДЫҚ ҚҰРАМЫНА ЖЫЛ ӘСЕРІ

Жұмыста қасапшылық мезгілдің түйелер (camelus dromedarius) LT бұлшық етінің май қышқылдық құрамына жыл әсері зерттелген. Суданның малшылары барлығы 30 түйені әртүрлі жыл мезгілінде: қыста, жазда және күзде сойған (әр мезгілде он түйеден). Алынған нәтижелер бойынша үш мезгілде түйе етіндегі липидтер мөлшері 11,7 г/100г құрады, яғни мезгіл бойынша ешқандай айрмашылық болған жоқ. LT бұлшықеті 52,2% ҚМҚ, 35,8% МҚМҚ, 11,6 ПҚМҚ және 0,5% CLA сәйкесінше құрады. Басқа жыл мезгілдеріне қарағанда жаз айларындағы сойылған етте МҚМҚ мөлшері басқа мерзгілмен салыстырғанда жоғары болды. Сонымен қатар, 18: 2 н-6/18: 3 н-3, н-6 / н-3 май қышқылдары, сондай-ақ ҚМҚ/ҚПМҚ қатынасы жоғары болды (P <0,05). Транс-11, цис-9 18: 2 изомерлердің пайыздық мөлшері де салыстырмалы түрде жоғары болса, н-6 / н-3 мөлшері адамның тағамдық қажеттілігін қамтитын мөлшерде болды. Түйе етінің LT бұлшық еті жыл бойына тағамдық құндылыққа ие.

Түйін сөздер: май қышқылдары, сою мезгілі, түйе еті, тағамдық құндылық

ВЛИЯНИЕ КУЛЬТУР ЗАКВАСКИ НА РАЗЛИЧНЫЕ КЛАССЫ ЖИРНЫХ КИСЛОТ В ТРАДИЦИОННОМ ФЕРМЕНТИРОВАННОМ ВЕРБЛЮЖЬЕМ (CAMELUS DROMEDARIUS) МОЛОКЕ СУДАНА ГАРИСС

Целью данного исследования было изучение изменения классов жирных кислот в гаррисе (традиционное ферментированное верблюжьего молоко), приготовленных в контрольных условиях (культуры закваски и времени ферментации). Посев сырого верблюжьего молока с выбранными LAB штаммами (E. durans R03, E. faecium NWL и L. plantarum BJ6 и их комбинации, а также контроля – ферментация без закваски) была выполнена в различные периоды времени (0, 3, 6 , 9 и 12 ч) при комнатной температуре, также изучались роль этих условий на классы жирных кислот. Верблюжье молоко при ферментации с заквасочными культурами в контрольных условиях содержит ненасыщенные жирные кислоты, в том числе незаменимыех жирные кислоты. Были обнаружены значительные количества жирных кислот omega-3 и omega-6 и отсутствие или присутствие в незначительных количествах короткоцепочечных жирных кислот по сравнению с коровьим молоком.

Ключевые слова: закваски, Enterococcus, классы жирных кислот, условия контроля, отдельные штаммы лактобактерии

Introduction

Camel population in Sudan estimated by 4.7million heads (1) raised on pasture or fattened for short finishing periods. The demand for camel meat appears to be increasing recently due to health reasons, as they produce meat with relatively low fat (2, 3, 4 and 5) in addition to low price compared to other species. Fatty acids profiles affect sensory attributes of meat such as flavour and juiciness (6).

Recently, nutritionists have focused on PUFA which is relatively high in camel meat in comparison to beef (4) and sheep (7). The balance in the diet between n-3 PUFA formed from alpha–linolenic acid (18:3) and n-6 PUFA formed from linoleic acid (18:2) (8) which is a risk factor in cancers and coronary heart disease, especially the formation of blood clots leading to heart attack (9). Limited reports are available on fatty acid composition in camel meat in Sudan (10). Therefore, there is a need to assess fatty acids composition and their seasonal variations in camel meat.

The objective of the current study was to investigate the effect of slaughter season on lipids and fatty acids composition of longissimus thoracis (LT) muscle from Sudanese desert camel (*Camelus dromedarius*).

Materials and methods

Thirty intact males, 2-3 years old of the one humped desert camels from Sudan were used for the purpose of the study. The animals were fattened by the herders on concentrated diet (21.4% crude protein and 11.8 Mj/kg ME) and Groundnut hay (*Arachis hypogea*) approximately 2 kg/ day (12.2% crude protein and 11.2 Mj/kg ME), Table 1. They were slaughtered at each season: winter, summer and autumn (ten camels per season) following the normal procedure in the abattoirs. Further details about the animals and sample collection have been reported previously (11). Samples from *Longissimus thoracis* muscle (L7-L8) (LT) were stored in plastic bags at -18° C until analysis.

Total lipid and fatty acid analysis were performed according to the standard method described by Folsh (12) to determine saturated, monounsaturated and poly unsaturated fatty acids.

Results and discussions

Saturated fatty acids

Total saturated fatty acids (SFA) constituted 52.2% of total fatty acids which was lower than the levels reported in LT muscle (13 and 14) of one humped camel (51.5 and 53%). In all the studied samples, palmitic acid (16:0) was the most abundant fatty acid among SFA during all seasons followed by Stearic acid (18:0); together they comprised 80.6 % of total SFA, however low concentration of Stearic acid was found (7.7%) in one humped camels (13). Furthermore, slightly high values of Palmitic and low values of stearic in bovine LT muscle fed on grains (16). No significant effect of slaughter season on palimtic and stearic acid in bovine LD muscle (17). slaughter season significantly affected stearic acid which was higher in autumn compared to winter and summer [21.2 *vs.* 19.4 and 18.5 %], respectively while no differences were found in palmitic acid. Furthermore, season did not influence Myristic acid (14:0) which was 5.2% (average of three seasons) which was higher than reported earlier 3.1% (14). Myristic acid was not realized in previous studies (21) and reported in low levels compared to our results (17).

Monounsaturated fatty acids

The total MUFA and *cis* MUFA were significantly high in summer compared to other seasons (*P<0.05)*. No significant differences were found in the 18:1 *trans* isomers (9, 10+11 and 12) among slaughter seasons although high levels in winter and summer observed compared to autumn. Olic acid (18:1 ∆ 9+10 *cis*) was the most concentrated MUFA among seasons (25.2%) followed by (3.3%) palmitoleic acid (16:1 ∆ 9 *cis*), comprising together 76.3% of the total MUFA. In contrast high levels of oleic acid (18:1) in camel LT muscle reported previously (13 and 14). Slaughter season significantly influenced (*P<0.05*) 18:1 delta 11 cis with level in winter being higher (2.24%) than in summer and autumn (2.2 and 1.9%). The concentration of the 18:1 *trans* isomers remained stable and could be due to the similar hay intake among seasons. However, the C18:1 *trans* isomers are ruminal biohydrogenation product of C18 PUFA associated with high intake of grass and quality that supplied PUFA substrates (22).

Polyunsaturated fatty acids

Linoleic acid was the major fatty acid in the studied samples constituting 50.9% (*P>0.05*) of the total PUFA followed by arachidonic acid (ARA; 20:4 n-6) 17.2%. Similar trend was found in bovine lean meat (23) and in camel LT muscle (13 and 14). The average of ARA was 1.9% which was higher than the values reported in camels (1.2%). Alpha-linolenic acid [18:3 n-3, *All-cis*] significantly affected by the slaughter season (*P<0.05).* It was 2 folds higher in winter than in autumn and summer [1.1 *vs.* 0.5 and 0.6%]. Eicosapentaenoic acid (EPA; 20:5, n−3) which is revealed in the studied samples and docosahexaenoic acid (DHA; 22:6, n−3) which was found in all the samples studied. The concentration of conjugated linoleic acid *trans*11, *cis*9 18:2 (CLA) was 0.5%, however no differences among seasons were observed. Total PUFA was high in winter and summer, but no significant differences were found. The overall mean (average of seasons) was 11%; higher than 5.3% in camel LT muscle (14).

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EFFECT OF STARTER CULTURES ON VARIOUS CLASSES OF FATTY ACIDS IN SUDANESE FERMENTED CAMEL MILK (CAMELUS DROMEDARIUS) GARISS

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Abstract

The objective of this research was to study the variation of classes of fatty acids in gariss (fermented camel milk) prepared under controlled conditions (starter cultures and time of fermentation). Inoculations of raw camel milk with selected LAB strains (E. duransR03, E.faecium NWL and L. plantarum BJ6 and their combination as well as the control - fermentation without starter cultures) was performed at varying periods of time (zero, 3, 6, 9 and 12h) at ambient temperature, then the role of these conditions on fatty acids classes were studied. Camel milk fermented under starter-culture controlled conditions contained unsaturated fatty acids, including the essential fatty acids. Considerable amounts of $omega_3$ and $omega_6$ fatty acids and the absence or presence of low amounts of short chain fatty acids were found compared to cow milk.

Key words: Starter cultures, Enterococcus, fatty acids classes, control conditions, selected LAB strains.

СУДАНДЫҚ ФЕРМЕНТАЦИЯЛАНҒАН ТҮЙЕ СҮТІ GARISS (CAMELUS DROMEDARIUS) МАЙ ҚЫШҚЫЛДАРЫНЫҢ ТҮРЛІ КЛАСТАРЫНА ҰЙЫТҚЫЛАРДЫҢ ӘСЕРІ

Зерттеу жұмысының мақсаты бақылау жағдайында дайындалған (ұйытқылар мен ашыту уақыты) Gariss (ашытылған түйе сүті) құрамындағы май қышқылдары класындағы өзгерістерді зерттеу.Таңдап алынған LAB штамдарымен (E. durans R03, E. faecium NWL, L. plantarum BJ6 және олардың комбинациялары, сондай – ақ бақылау – ұйытқыларсыз ашуы) түйенің шикі сүті түрлі уақыт кезеңдерінде (0, 3, 6 , 9 және 12 сағ) бөлме температурасында ашытылды, сонымен қатар, май қышқылдарының кластарына олардың әсер ету рөлі зерттелді. Зерттеу нәтижесінде сиыр сүтімен салыстырғанда omega-3 және omega-6 май қышқылдарының жоғары мөлшері мен қысқа тізбекті май қышқылдарының төмен мөлшері анықталды.

Түйін сөздер: ұйытқы, Enterococcus, май қышқылдарының кластары, бақылау жағдайы, лактобактериялардың жеке штамдары

ЭФФЕКТ ЗАКВАСОЧНЫХ КУЛЬТУР НА РАЗЛИЧНЫЕ КЛАССЫ ЖИРНЫХ КИСЛОТ В СУДАНСКОМ ФЕРМЕНТИРОВАННОМ ВЕРБЛЮЖЬЕМ (*CAMELUS DROMEDARIUS*) МОЛОКЕ GARISS

Целью данного исследования было изучение изменения классов жирных кислот в Gariss (ферментированное верблюжьего молоко), приготовленных в контролируемых условиях (культура заквасок и времени ферментации). Посев сырого верблюжьего молока с выбранными LAB штаммами (*E. duransR03, E.faecium NWL u L. Plantarum BJ6 и их комбинации, а также контроля – ферментация без закваски*) была выполнена в различные периоды времени (0, 3, 6 , 9 и 12 ч) при комнатной температуре, также изучались роль этих условий на классы жирных кислот. Верблюжье молоко при ферментации с заквасочными культурами в контролируемых условиях содержит ненасыщенные жирные кислоты, в том числе незаменимыех жирные кислоты. Были обнаруженыа значительные количества жирных кислот omega-3 и omega-6 и отсутствие или присутствие в незначительных количествах короткоцепочечных жирных кислот по сравнению с коровьим молоком.

Ключевые слова: закваски, Enterococcus, классы жирных кислот, условия контроля, отдельные штаммы лактобактерии

Introduction

The study of microflora in traditional fermented dairy products as *gariss* and preparation of starters is of a good concern. To obtain the *gariss* with better quality and to produce this traditionally fermented product at the industrial level with high quality, control starter cultures must be used. For many authors, the presence of enterococci is evidence of possible fecal contamination and therefore a risk to consumers because although these strains are known for their low virulence, they pose serious health problems due to the emergence of many antibiotic-resistant strains (Akhmetsadykova *et al.,* 2014).